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Depending on the causes of storm sewer overflows for a particular system, green infrastructure approaches can be used together with grey infrastructure improvements help eliminate such overflows.

Sanitary Sewer Overflows

This factsheet is the third in a series of six on integrating green infrastructure concepts into permitting, enforcement, and water quality standards actions.

Integrating Green Infrastructure Concepts into Permitting, Enforcement, and Water Quality Standards Actions

*This factsheet is the third in a series of six factsheets in the U.S. EPA Green Infrastructure Permitting and Enforcement Series (*http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries*). This series describes how EPA and state permitting and enforcement professionals can incorporate green infrastructure practices and approaches into National Pollutant Discharge Elimination System (NPDES) wet weather programs, including stormwater permits, Total Maximum Daily Loads (TMDLs), combined sewer overflow (CSO), long-term control plans (LTCPs), and enforcement actions. This series builds upon EPA's continued investment in green infrastructure and low impact development. Existing EPA authority, guidance, and agreements enable EPA Regions and state agencies to work with permittees to include green infrastructure measures as part of control programs.*

For additional resources on green infrastructure, go to the EPA Green Infrastructure Web page: http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm**.**

Key green infrastructure guidance issued to date can be found at: http://water.epa.gov/infrastructure/greeninfrastructure/gi_policy.cfm.

Introduction

Properly designed, operated, and maintained sanitary sewer systems are meant to collect and transport all of the sewage that flows into them to a publicly owned treatment works (POTW). However, in some communities under some circumstances discharges of raw sewage from municipal sanitary sewers may occur. These types of discharges are called sanitary sewer overflows (SSOs). SSOs may be attributable to blockages in the system or mechanical failure such as a lift station power outage. In addition, SSOs often occur because of excessive "I&I" – infiltration of water into collection systems and inflow. In the context of SSOs, infiltration means stormwater or groundwater that seeps into the sewer system through cracks and other vulnerable locations in the pipes and joints. Inflow is the introduction of stormwater into the sanitary sewer system via specific storm connections, either deliberate or inadvertent. Common sources of inflow are the connection of roof downspouts or discharges from sump pumps to the sanitary sewer system.

Where there is excessive I&I of rainwater and/or groundwater into the sanitary sewer system, the system may become overloaded and overflow. All flows in sanitary sewer systems need to be transported to treatment plants and treated in accordance with NPDES permit requirements. EPA guidance on SSOs can be found here:

PERMITTING: http://cfpub.epa.gov/npdes/home.cfm?program_id=4

ENFORCEMENT: http://cfpub.epa.gov/compliance/resources/policies/civil/cwa/

Grey infrastructure improvements/expansions and implementation of a capacity, management, operations and maintenance (CMOM) or remedial measures program are among the traditional approaches used to bring separate sanitary systems into compliance with the Clean Water Act. Depending on the causes of SSOs for a particular system, green infrastructure approaches may be used in conjunction with grey infrastructure improvements and CMOM to help eliminate SSOs. Green infrastructure may help by keeping some wet weather flows out of the separate sewer system.

Green infrastructure approaches may be ideal solutions for inflow problems. They are preventive measures rather than treatment measures, and eliminate or reduce the need to create additional capacity in the sewer system by keeping water out of the system. Disconnecting sources of stormwater to sanitary sewer systems should be a high priority for any SSO abatement program. Downspouts and other stormwater conveyances should not simply be rerouted to storm sewer systems as that is simply a transfer of the water quality problems from one system to another. Instead these sources should be routed to rain barrels, cisterns, rain gardens, swales or other measures where the stormwater can recharge groundwater, irrigate landscapes, or serve other non-potable water needs. A number of communities have successfully instigated downspout disconnection programs to keep water out of sewer systems (sanitary, combined and storm). In these situations rainwater is typically directed to vegetated areas where stormwater can be infiltrated and evapotranspired, or directed to water harvesting devices.

CMOM or Remedial Measures Plan Components

For examples of municipal downspout disconnection programs see:

http://cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm#downspout

When infiltration of water into the sanitary sewer system is the primary problem, the most effective solution is typically sanitary sewer rehabilitation. In the interim, reducing the amount of groundwater and stormwater near the laterals and joints that may be allowing water into the pipes may be a goal. In this particular situation green infrastructure approaches are still valuable, but there are important considerations: 1) Practices that encourage infiltration of stormwater into the ground should be located away from laterals where 'leaky' systems are identified or suspected; and 2) placement of trees relative to pipes, especially older or 'leaky' pipes, should be carefully considered in order to avoid root growth into joints.

CMOM or Remedial Measures Plan Components

As noted, a CMOM program may be an important tool for preventing SSOs and bringing sanitary sewer systems into compliance with the Clean Water Act. The following sections discuss how CMOM plans can be adapted to accommodate green as well as grey infrastructure.

Capacity Estimates: Green infrastructure may reduce the capacity improvements required to prevent SSOs. The process of estimating the capacity improvements required for plans that include green infrastructure may be divided into two steps. The first step is to estimate the volume of water that can be kept out of the system, based on estimates of the collective capacities of distributed green technologies. The second step consists of fairly standard hydraulic modeling of the system. This step is required regardless of the type of technologies in use, in order to determine discharge reductions at respective outfalls or overflow points.

In general, estimating the impact of distributed controls located throughout a sewershed on accumulated flow at a discharge point can be more complicated than estimating the impact of a single control at one location (e.g., as with

CMOM or Remedial Measures Plan Components

- Capacity estimates
- Legal authority
- Maintenance
- Monitoring
- Mapping/tracking

CSOs, where one central tunnel or basin may be used to enhance capacity). However, in the case of SSOs, modeling green technologies may not differ very much from modeling more traditional technologies since reducing inflow is traditionally accomplished through the removal of many individual sources to the system.

Legal Authority: Reduction of inflow through the use of green infrastructure may present novel legal issues when these controls are located on privately owned land. Where bioinfiltration cells or other structures are installed on private property, maintenance agreements, local ordinance or other enforceable mechanisms will be required to allocate legal responsibility for proper operation and maintenance of the control measures.

Maintenance: As discussed above, green infrastructure controls may be located on private property. For these practices, legal mechanisms and institutional arrangements typically need to be in place to ensure proper maintenance. The community may want to establish education programs or simple guidance materials for maintenance of green infrastructure practices that will be maintained by private property owners or operators.

When practices are located on public lands or within public rights-of-way, the municipal operator should establish standard operating procedures for maintenance that include schedules, and procedures for maintenance, reporting and tracking.

Monitoring: Monitoring provisions for green and grey infrastructure solutions should be very similar. Documenting performance of individual control measures typically is not necessary as part of a monitoring program; a solid maintenance program will ensure long-term function. Since the goal of the SSO abatement program is to reduce flows into the system and overflows out of the system, variables that address those objectives (e.g., in-pipe flow monitoring or tracking of volume and frequency of overflows) may be appropriate metrics. In cases where green infrastructure to reduce inflow is a major part of the overall SSO reduction strategy, monitoring similar to that recommended in the CSO context would also be appropriate.

Mapping/Tracking: As relevant, mapping or otherwise identifying the locations of control measures (whether grey or green) is important for when maintenance is required and performed. See case study below.

CMOM guidance is provided in this document:

http://www.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf

State of California Case Study

As an example, the State of California has established procedures concerning monitoring and mapping. All collections systems in California must report their sanitary sewer overflows in accordance with State Water Resources Control Board, Order No. 2006-0003-DWQ, Monitoring and Reporting Program, Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, issued May 6, 2006, and amended by State Water Resources Control Board Order No. WQ 2008-0002-EXEC on February 20, 2008. Each collection system must enroll for coverage under this Order and register with the online reporting database. Enrollees must report the details of each spill to the database, providing information which includes: date of SSO, whether it reached surface water, total volume, total volume recovered, total volume reaching surface water, location of the spill, time the agency was notified, time the operator arrived, time the spill ended, actions taken to stop the SSO and perform clean-up activities, and planned future actions for that site. The database is publicly accessible, and users can search for and view reported SSOs statewide by Street Address, County, Responsible Agency, Spill Start & End Dates, Water Board Region, and Spill Category. The State Board has launched a web-based GIS mapping tool using Google Earth base maps for plotting all SSOs and private lateral spills in the State.

Links to the California order, database and mapping tool, fact sheets, and other information are at: http://www.waterboards.ca.gov/water_issues/programs/sso/index.shtml#general

Consent Decree Components

Green infrastructure approaches may be a useful component of judicial consent decrees entered in Clean Water Act enforcement actions to resolve SSO violations.

An SSO decree providing for green infrastructure may include the following concepts:

The Collection System and Waste Water Treatment Plant (WWTP) Remedial Measures Plan should identify all measures necessary to achieve adequate capacity. If green infrastructure is proposed as a solution to reduce system capacity demands, it should be identified in this Plan. The Plan shall include specific metrics that can be measured and quantified on a continuous basis. If green infrastructure is used, the operator shall demonstrate appropriate legal authority to ensure adequate operations and maintenance.

The reporting provisions of a consent decree or administrative order contain numerous specific provisions.

Green infrastructure approaches may be a useful component of judicial consent decrees entered in Clean Water Act enforcement actions to resolve SSO violations.

As with other reporting requirements, a summary that quantifies the effectiveness of all measures, including green infrastructure measures, should be included.

Should evaluation of metrics indicate that green infrastructure measures are not providing the anticipated flow volume reductions to the sanitary sewer system, the Plan should identify additional actions consistent with meeting the SSO abatement objectives.

Planting drought-tolerant grasses and trees in areas with impervious surfaces is one approach to reducing storm water sewer loads and overflows using green infrastructure.

Green Infrastructure Permitting and Enforcement Series

This series on integrating green infrastructure concepts into permitting, enforcement, and water quality standards actions contains six factsheets plus four supplemental materials that can be found at ***http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries****.*

Factsheets

1. Potential Challenges and Accountability Considerations
2. Combined Sewer Overflows
3. Sanitary Sewer Overflows
4. Stormwater
5. Total Maximum Daily Loads
6. Water Quality Standards

Supplemental Materials

1. Consent Decree Provisions Addressing Substitution of Green Infrastructure Control Measures for Planned Grey Infrastructure Control Measures
2. Case Studies of Green Infrastructure in Total Maximum Daily Loads (TMDLs)
3. Consent Decrees that Include Green Infrastructure Provisions
4. Green Infrastructure Models and Calculators

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For additional resources on green infrastructure, go to the EPA Green Infrastructure Web page: http://www.epa.gov/greeninfrastructure/.